Poland Petroleum Refinery Sludge Lagoon Cleanup Using a Biopile

T. C. Hazen[1], A. J. Tien[2], A. Worsztynowicz[3], D. J. Altman[2], K. Ulfig[3], G. Plaza[3], and T. Manko[3]

[1]*Lawrence Berkeley National Laboratory, Berkeley, California, USA*
[2]*The Environmental Biotechnology Section, Savannah River Technology Center, Westinghouse Savannah River Company, Aiken, South Carolina, USA*
[3]*Institute for Ecology of Industrial Areas, 6 Kossutha St., Katowice, Poland*

The US Department of Energy and the Institute for Ecology of Industrial Areas of Poland demonstrated bioremediation techniques for the clean up of acidic petroleum sludge impacted soils at an oil refinery in southern Poland. The waste was composed of high molecular weight paraffinic and polynuclear aromatic hydrocarbons. Benzo(a)pyrene and BTEX compounds were identified as the contaminants of concern. Approximately 3,300 m^3 of contaminated soil (TPH ~ 30,000 ppm) was targeted for treatment. A biopile design which employed a combination of passive and active aeration in conjunction with nutrient and surfactant application was used to increase the biodegradation of the contaminants of concern. Over the 20 month project, more than 81% (120 metric tons) of petroleum hydrocarbons were biodegraded. Despite the fact the material treated was highly weathered and very acidic, biodegradation rates of 121 mg/kg soil/day in the actively aerated side (82 mg/kg soil/day in the passive side) were achieved in this biopile. Microbial counts and dehydrogenase measurements gave the best correlation with the biodegradation rates. Passive aeration was shown to reach the same endpoint, but took twice as long as active aeration. Modeling demonstrated that contaminant mass transfer was the rate-limiting step for biodegradation. Costs were competitive or significantly lower when compared with other ex situ treatment processes.

Supported by Department of Energy under Contract No. DE-AC03-76SF00098.